



A Grain of Truth

Summary

Observe howling winds and powerful waves creating, shaping, eroding and moving sand dunes. Hike approximately one mile along beach and foredune trails to see and learn about the processes of glaciation, erosion, and dune building. Take time to sit and use your senses to experience the beauty of the dunes.

Objectives

The students will be able to:

1. Describe the role of glaciers in the formation of Lake Michigan.
2. Explain how waves, wind, and plants help form and shape the dunes.
3. Describe what they observed, heard and felt while exploring the dunes and beach.
4. Give examples of how humans alongside the National Park Service can help protect the dunes.
5. List at least three plants found on the dunes.



What to Expect During your Field Trip

1. Group arrives at either West Beach or Mt. Baldy for the program. Check your program sheet for correct location.
2. The 90 minute program is completely outdoors and includes a mile long hike along the beach and through the dunes.
3. Students will be engaged in exploration activities along the trail to learn about the special features in the dunes. After the conclusion, the group is welcome to have lunch in the nearby picnic shelter.

Setting: West Beach is located in Portage, and Mount Baldy is located in Michigan City, Indiana. The trail at each location is about one mile in length. Restrooms and picnic shelters are available at both sites. Portions of the trail at West Beach are wheelchair accessible. Two beach wheelchairs are available for use at West Beach.

Grade: 4th-12th grade

Ratio of Students to Ranger: 30 to 1; up to 90 total at Mount Baldy and up to 120 at West Beach. Please provide one adult chaperone for every ten students.

Safety issues: Poison ivy, slivers on boardwalks, seasonal excessive heat or cold, safety on stairs and dune climbs. Students should dress for the weather and wear shoes suitable for hiking. Some adults and children may have difficulty walking the trails and climbing the dunes, which are steep in some areas. Please contact the park if your class has any special needs or accommodations .

For More Information: See the park's education website at www.nps.gov/indu/forteachers/. Contact the park's scheduling office at (219) 926-7561, ext. 243.

Background Information:

Geology: The first dunes of Indiana were formed approximately 15,000 years ago when the last of the Ice Age glaciers swept down from the north. As the climate warmed, the movement of the glacier was halted, and a glacial deposit called a moraine was formed. This moraine acted as a dike holding back the water of the melting glacier forming what is now Lake Michigan. Waves, wind, and plants have all combined to bring sand to the southern and eastern shores of Lake Michigan and to begin the dune building process. The process of dune building that began so long ago continues today. Through the dynamic process of succession, a variety of biological communities succeed one another on the dunes of West Beach. Each community changes the physical and biological environment making conditions suitable for the next community.

The shoreline of the new lake first stood at 640 feet high, but this was only temporary. The increasing influx of meltwater from the ice to the north soon caused the lake to breach its morainic dam near what is now the southwest part of Chicago. As water passed out of the opening in the moraine and down the DesPlaines and Illinois valleys, the level of ancestral Lake Michigan fell. A new, lower lake level was established when the down-cutting of the DesPlaines River was stabilized by a boulder-rich zone with the Valpariaso Moraine. The new lake level, which stabilized at 620 feet, was also only temporary. When the boulder field near southwest Chicago was breached, the lake began to lower again until a third level at 605 feet was reached. This was caused by the downcutting of the Illinois River. Its tributaries virtually ceased when the river reached bedrock. This third lake level was to be the last stage of ancestral Lake Michigan.

By this time, the glaciers had completely left the Lake Michigan Basin. A new drainage was opened at the Straits of Mackinac, to the north, which was lower than the outlet at Chicago. Today, this drainage is still the principal drainage of the lake.

Geologists refer to the three lake levels of ancestral

Lake Michigan as the following: 1) Glenwood at 640 feet elevation; 2) Calumet at 620 feet; and 3) Tollestonat 605 feet.

At each of these lake stages, beaches and their accompanying foredunes are preserved. The transition to modern day Lake Michigan was a gradual one involving numerous rises and falls of the lake level. Even today the lake level is not fixed, as evidenced by a two to three foot rise during the past several years. The mean average level of Lake Michigan over the past 100 years is about 585 feet.

Succession: A progression of plant communities is found on the dunes along the south shore of Lake Michigan. Moving from beach to oak forest in the dunes, the amount of sunlight decreases. This is due to the community plant composition. Near the lake, sun-tolerant cottonwoods and grasses grow. Shade-tolerant oak, witchhazel, and other broad-leaved trees and shrubs grow in the oak forest. Sunlight, evaporation, and transpiration decrease from beach to oak forest, while the amount of moisture available to the soil increases. Since there is a greater quantity of organic material in the soil progressing from beach to oak forest, the soil is more capable of holding moisture.

The vegetation controls the amount of sunlight striking the ground. As the plants grow, they create shade, which modifies the light and moisture conditions on the ground. Trees sometimes have unusual bent or twisted growth patterns, which results from their competition for available sunlight.

Dune grasses have adapted ways to reproduce and spread. They may have underground runners and the ability to shoot up new stems to prevent sand burial. Others produce enormous quantities of seeds which travel by wind. In the foredunes, a greater part of the plant is underground. This enables plants to capture and hold sand in place to build dunes.

Prerequisite Classroom Activities:

Prior to your visit to Indiana Dunes National Lakeshore, please take a moment to read through the information listed below. We suggest that you do one or more of the described activities with your class in order to prepare them for the lessons and experiences they will have during their field trip. If there is a special topic or area that you want the ranger to cover during the presentation, please contact the park's scheduling office. Every effort will be made to accommodate your request.

Great Lakes in My World:

The attached activities are from the "Great Lakes in My World" curriculum guide, produced by the Alliance for the Great Lakes. You can find more information about the curriculum guide and how to order it on the Alliance's website: www.greatlakes.org

"Dune Journey", pg. 98 (3rd-6th grade)

"Sand Study", pg. 105 (3rd-6th grade)

"Moving Sand", pg. 110 (4th-8th grade)

Other possible activities:

Activity 1: Students pretend they are a grain of sand and write a story on how they would travel across Lake Michigan to West Beach or Mt. Baldy.

Activity 2: Students examine a map or atlas of the world and find other areas which have sand dunes. Compare the differences and similarities between these areas and the southern shore of Lake Michigan. Have students work in groups to research a park and present their findings to the class. Beginning in the United States, students can research the differences and similarities between our Indiana dunes with those found at the following national parks:

- Sleeping Bear Dunes National Lakeshore—www.nps.gov/slbe
- Great Sand Dunes National Monument and Preserve—www.nps.gov/grsa
- White Sands National Monument—www.nps.gov/whsa
- Pictured Rocks National Lakeshore—www.nps.gov/piro
- Cape Cod National Seashore—www.nps.gov/caco

Activity 3: Students make a list and discuss the uses of sand by humans.

Activity 4: Students make a poster which urges people to protect the dunes of Indiana.

Activity 5: Students research one of the common plants of the dunes listed below. They should find out what it looks like, what kind of plant it is (tree, shrub or flower) and if it has any special adaptations for survival.

Vocabulary

ADAPTATION – something that a plant or animal has or does that enables it to survive

BEACH – the sandy, pebbly, or rocky shore of a body of water

DECOMPOSE – to cause chemical disintegration of organic matter

DUNE - a ridge or hill of wind-blown sand

GLACIER— a large body of ice moving slowly down a slope or valley or spreading outward on a land surface, usually carrying, pushing, or depositing loose rock and other debris and eroding land forms along the way

PANNE – a pond that is located within a dune complex

RHIZOME— a rootlike, usually horizontal stem growing under or along the ground that sends out roots from its lower surface and leaves or shoots from its upper surface

SAND – loose, granular, gritty particles of worn or disintegrated rock, finer than gravel and coarser than dust

Plants common to the dunes

Beach Community:

bugseed
Russian thistle
seaside spurge
sea rocket
winged pigweed

Foredune Community:

artic bearberry
common milkweed
cottonwood tree
fragrant sumac
hairy puccoon

hop tree
horse mint
jack pine
little bluestem grass
marram grass
pasture rose
poison ivy
prickly pear cactus
riverbank grape
sand cherry
sand cress
sand thistle
wormwood

Follow-up Activity

Class reflection paper or writing sample:

Ask each student to write a short essay, letter or story about what they learned on their field trip to Indiana Dunes National Lakeshore. Rangers love receiving mail from their students. Send the ranger the packet of essays from your class (or a copy of them), and your ranger will send your class a certificate from the dunes. Send your essays to: **Indiana Dunes National Lakeshore, 1100 N. Mineral Springs Road, Porter, IN 46304, Attn: Your ranger's name or just Education Department.**

If you are using this essay as a class assignment for a grade, we would like to suggest that each essay contain the following elements. **Use the rubric on the next page to score them.**

- The name of the park and the location of their field trip—for example: Douglas Center, Indiana Dunes National Lakeshore
- Three facts they learned on the field trip about the geology of the dunes.
- A brief explanation of why Indiana Dunes is unique and therefore a national park.
- At least two things the student can do to help take care of his or her national park.
- Fill in the blank of this statement and provide an explanation: I would like to learn more about _____ at Indiana Dunes.

Assessment:

Rubric for Class reflection writing assignment:

Elements	4 points	3 points	2 points	1 point
Writing and organization	The writing sample is very well written and organized by the elements provided. It has a strong introduction, middle and conclusion.	The writing sample is well written and organized by the elements provided. It includes an introduction, middle and conclusion.	The writing sample is choppy and is not well organized. It lacks an introduction or conclusion.	The writing sample is very short and unorganized.
Grammar & Spelling	Mistakes in spelling and grammar are minor or non-existent.	Mistakes in spelling and grammar are minimal—about 4-5.	Mistakes in spelling and grammar are numerous—5-10.	Mistakes in spelling and grammar are more than 10.
Facts and content	The writing sample demonstrates the student's learning on the dunes program and includes three or more facts provided by the park staff.	The writing sample demonstrates the student's learning and includes only two facts provided by the park staff.	The writing sample does not demonstrate much learning and only includes one fact provided by the park staff.	The writing sample does not demonstrate any learning and does not include any facts provided by the park staff.
National Park Service theme	The writing sample clearly demonstrates the student's understanding of the role of the NPS in preserving the dunes by explaining why Indiana Dunes is such a unique treasure.	The writing sample mentions the NPS and its role in preserving the Indiana Dunes.	The writing sample mentions the NPS and Indiana Dunes.	The writing sample does not mention anything about the NPS or its role at Indiana Dunes.
Stewardship	The writing sample lists three things the student can do to assist in taking care of the Indiana Dunes.	The writing sample lists two things the student can do to assist in taking care of the Indiana Dunes.	The writing sample lists one thing the student can do to assist in taking care of the Indiana Dunes.	The writing sample does not list anything about what the student can do to take care of the Indiana Dunes.

Illinois Content Standards

The *A Grain of Truth* program can assist teachers in meeting the following Illinois standards in science.

State Goal 11: Understand the processes of scientific inquiry and technological design to investigate questions, conduct experiments and solve problems. Know and apply the concepts, principles and processes of scientific inquiry.

11.A.2b Collect data for investigations using scientific process skills including observing, estimating and measuring.

State Goal 12: Understand the fundamental concepts, principles and interconnections of the life, physical and earth/space sciences. Know and apply concepts that explain how living things function, adapt and change.

12.A.2a Describe simple life cycles of plants and animals and the similarities and differences in their offspring.

Know and apply concepts that describe how living things interact with each other and with their environment.

12.B.2a Describe relationships among various organisms in their environments (e.g., predator/prey, parasite/host, food chains and food webs).

12.B.2b Identify physical features of plants and animals that help them live in different environments (e.g., specialized teeth for eating certain foods, thorns for protection, insulation for cold temperature).

12.B.3a Identify and classify biotic and abiotic factors in an environment that affect population density, habitat and placement of organisms in an energy pyramid.

12.B.3b Compare and assess features of organisms for their adaptive, competitive and survival potential (e.g., appendages, reproductive rates, camouflage, defensive structures).

12.B.4a Compare physical, ecological and behavioral factors that influence interactions and interdependence of organisms.

12.B.5a Analyze and explain biodiversity issues and the causes and effects of extinction.

Know and apply concepts that describe the features and processes of the Earth and its resources.

12.E.2a Identify and explain natural cycles of the Earth's land, water and atmospheric systems (e.g., rock cycle, water cycle, weather patterns)

12.E.2b Describe and explain short-term and long-term interactions of the Earth's components (e.g., earthquakes, types of erosion).

12.E.5 Analyze the processes involved in naturally occurring short-term and long-term Earth events (e.g., floods, ice ages, temperature, sea-level fluctuations).

State Goal 13: Understand the relationships among science, technology and society in historical and contemporary contexts.

Know and apply the accepted practices of science.

13.A2c Explain why keeping accurate and detailed records is important.

13.A.3c Explain what is similar and different about observational investigations.

Know and apply concepts that describe the interaction between science, technology and society.

13.B.2a Explain how technology is used in science for a variety of purposes (e.g., sample collection, storage and treatment; measurement; data collection, storage and retrieval; communication of information).

13.B.2e Identify and explain ways that technology changes ecosystems (e.g., dams, highways, buildings, communication networks, power plants).

13.B.2f Analyze how specific personal and societal choices that humans make affect local, regional and global ecosystems (e.g., lawn and garden care, mass transit).

13.B.3c Describe how occupations use scientific and technological knowledge and skills.

13.B.3d Analyze the interaction of resource acquisition, technological development and ecosystem impact (e.g., diamond, coal or gold mining; deforestation).

13.B.3e Identify advantages and disadvantages of natural resource conservation and management programs).